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(58) Field of search

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(54) Monitoring movable equipment and goods

(57) In a system for keeping track of the locations, and the movements between locations, of items of equipment (e.g. scaffolding components), each item 10 is marked on manufacture with a unique identifier 12, and its existence is electronically recorded in a register in a central digital processor store 42. Each movement (actual or intended) of an item is electronically monitored and recorded in the central store, so as to update the register as to the whereabouts of the item, and any intended future location. For that purpose, each location has an electronic reading head for scanning the identifier of each item entering or leaving the location, and relaying corresponding electronic signals to the central store. Interrogation units are provided at some locations for interrogating the central store to ascertain the location and/or other particulars of an item bearing a specified identifier. Relevant details of each item, including its owner, may be stored in the central store in association with its identifier.

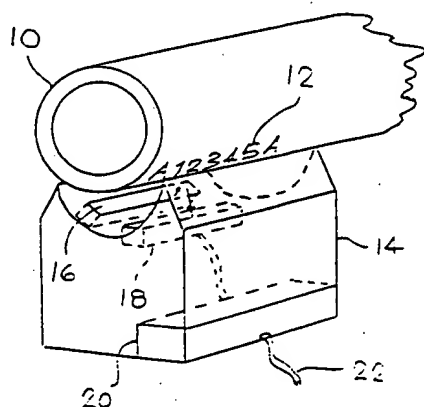


FIG. 1

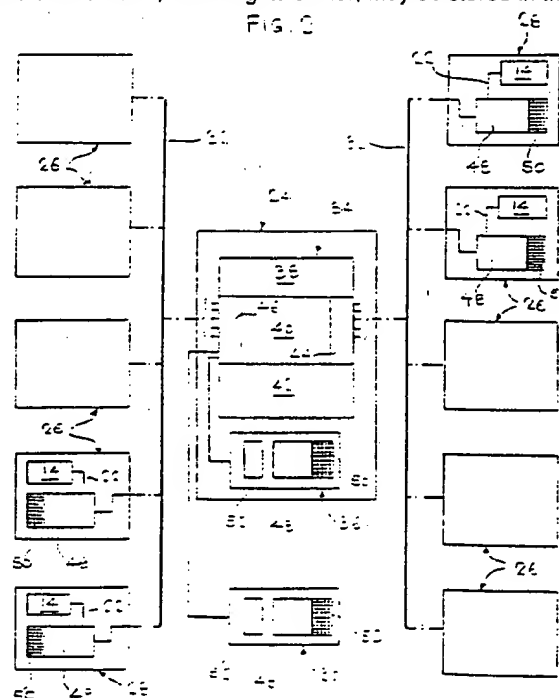


FIG. 2

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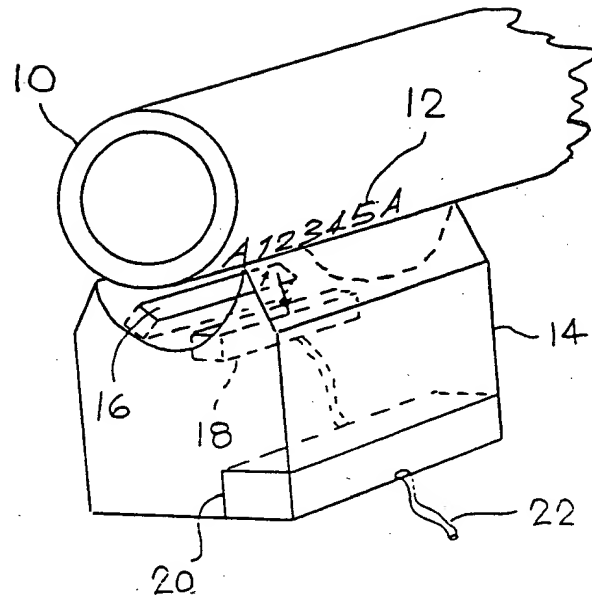


FIG. 3

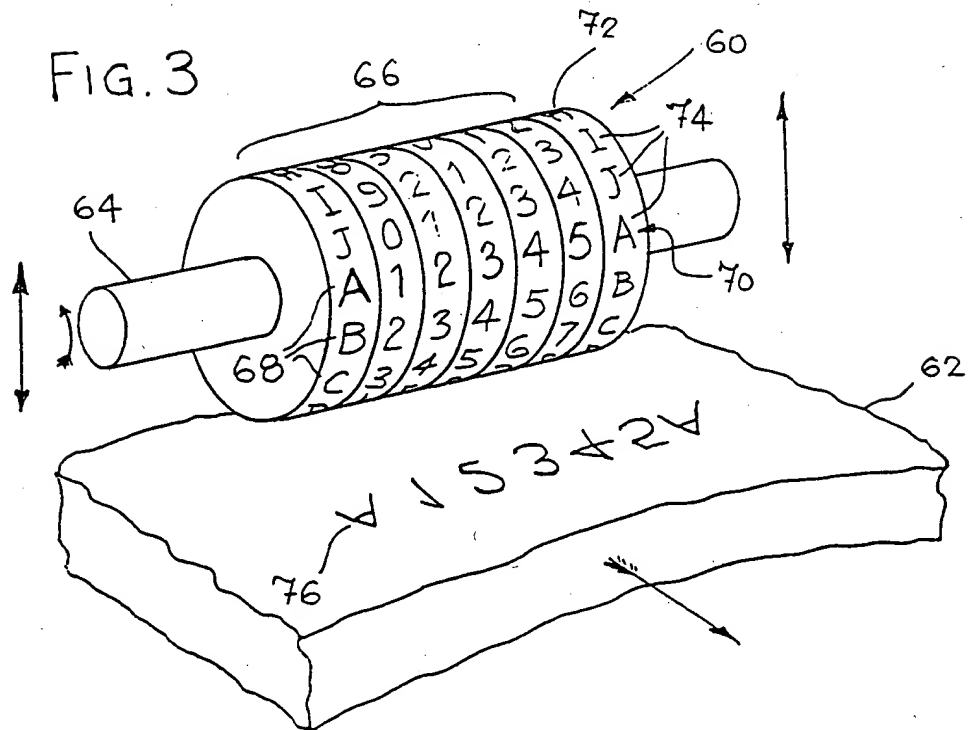
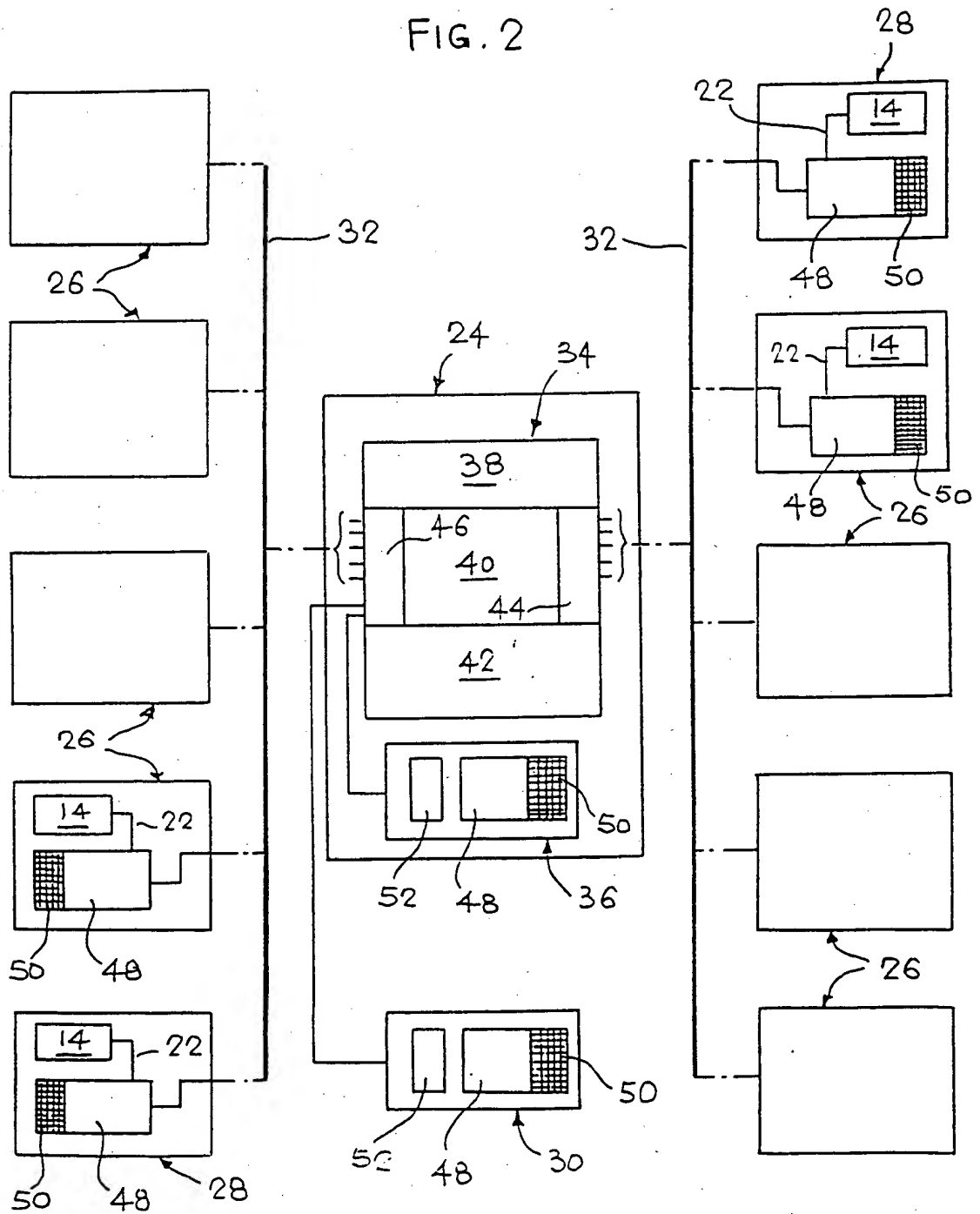


FIG. 2



MONITORING MOVABLE EQUIPMENT AND GOODS

5 This invention relates to a means for and a method of monitoring movable items of equipment or goods which during their lifetime are likely to be transferred, from time to time, from one site or location to another, and/or from one owner to another.

10 Such items of equipment or goods may comprise items which are let out on hire to third parties for use by them in their normal business operations, or items owned by a large organisation and placed at the disposal of various divisions within the organisation, temporarily or permanently, to enable them to perform their respective functions.

15 Such items may comprise, for example, items of scaffolding equipment, or heavy or other plant for use in building or civil engineering operations, or electronic equipment for use in medicine, education, entertainment, commerce, 20 industry, etc. or in recording or broadcasting operations.

Such items when removed from the physical control of their owners are easily mislaid, and can become irretrievably lost to the owners.

25 The present invention seeks to provide a means for and a method of readily revealing in respect of any specified item of equipment or goods the identity of the current owner and/or of the current location at which it should be 30 situate.

The present invention will now be discussed in detail, by way of example, in relation to the hiring out of items of scaffolding equipment.

35 Scaffolding equipment for use in connection with building work nowadays is made up principally of scaffold poles in the form of pieces of steel tub, made in various lengths

and diameters, steel clips for inter-connecting intersecting scaffold tubes, and steel adaptors for connecting scaffold tubes end-to-end.

5 There is currently a substantial mis-appropriation and mis-
use of items of scaffolding equipment, which items though
individually marked with colour coded parts or other indicia
indicating the owner, become irretrievably lost to the
owner. Thus, substantial financial losses are suffered each
10 year by those who own or otherwise let out for hire
scaffolding items.

Mis-appropriated items can on recovery by a law enforcement
authority be restored eventually to their original owner
15 (not necessarily their rightful owner), but there is no
ready means of determining from which location they had been
removed, nor their rightful owner, and no means of
uncovering the mechanism by which they had been
misappropriated.

20 The present invention seeks to provide a means and method
whereby such losses can be checked, and hopefully reduced.
The present invention also seeks to provide a means whereby
not only the current ownership of each item of scaffolding
25 equipment can be readily determined, but also from which
location it was removed without authority, and whether it is
complete or part of some larger item, as for example where a
scaffold pole has been cut to provide shorter poles.

30 According to one feature of the present invention, items of,
for example, scaffolding equipment are marked individually
and uniquely with indicia that identify uniquely the item,
and preferably the owner of the item, and preferably
signify, inter alia, the type and size of the item. Such
35 indicia are arranged and impressed in such a way that they
cannot be removed without rendering the item unfit for its
intended purpose, and cannot be otherwise readily
obliterated without leaving tell-tale evidence of such

obliteration. Moreover, such indicia are arranged in a manner such that they can be readily and automatically scanned and read by a data reading head, so as to deliver output digital signals representing the scanned indicia.

5

Preferably, the indicia are coded in a special manner such as to render them not readily decoded without the use of such a data reading head.

10 According to another feature of the present invention, there is provided an automatic monitoring system for providing on demand, or periodically, output signals identifying at least the owner, and preferably the present location and/or the type and size of any specified item or items of equipment.

15

Such a monitoring system may comprise:

1) at a central monitoring station -

a data processor having a program device, and a storage means, the storage means being arranged for the assembly
20 therein of a register of the individual items of equipment that are registered in the system, each such item being registered under its individual identity and each such registration including, inter alia, the owner, and preferably, the type and size of the item, the current
25 location of the item, and where appropriate an assigned next destination for the item, and the program device being arranged for causing the processor (a) in response an up-date signal to automatically up-date the status of the stored register in dependence upon input data signals
30 received from user terminals, and (b) in response to an interrogation signal to automatically interrogate the stored register in respect of any specified item of equipment whereby to determine at least the owner, and preferably the current location of that item, and if desired, any other
35 stored data that is required;

2) at each of a predetermined plurality of remote distribution stations -

(i) an indicia reading head arranged to scan identity

indicia marked on each item of equipment which is presented to it on arrival at, or before departure from, the distribution station and to produce in response to such scanned indicia respective identity signals which uniquely
5 identify the respective items of equipment,

(ii) a user terminal associated with said reading head for receiving therefrom such identity signals, and including (a) means for connecting the terminal as required via a communications link (e.g. a telephone line or radio link)
10 with an input circuit of said data processor whereby to enable the transmission to said processor of a said update signal and of such identity signals, and (b) a keyboard for keying-in, in association with each such identity signal, a 'destination' signal signifying another distribution station
15 or other location (e.g. a building site) to which the relevant departing item of equipment is about to be transferred, or an 'origin' signal signifying another distribution station or other location (e.g. a building site) from which an arriving item has just been received,
20 and

3) at each of a predetermined interrogation stations - an interrogation means connected with an input circuit of said processor and incorporating a keyboard for keying-in the identity of any item of equipment in respect of which
25 the stored register is to be interrogated whereby to ascertain the current owner, and if desired the current location of the item, and any other desired data concerning that item.

30 Preferably, one such interrogation station is located at said central station, whilst another such interrogation station is located remotely at for example the offices of a criminal investigation bureau.

35 According to another feature of the present invention, such system also includes one or more remote manufacturing stations at which such items of equipment are manufactured and marked with unique identity indicia, and there is

provided at each such manufacturing station -

- 1) an indicia reading head arranged to scan identity indicia marked on each newly manufactured item of equipment, and
- 2) a said user terminal, the keyboard in this case being used for transmitting to said processor the identity of, and other significant details concerning each newly manufactured item, including the distribution station or other location (e.g. a building site) to which the item is to be assigned and despatched, for incorporation in the stored register.

The said indicia reading heads may comprise static devices to which the respective items of equipment are to be physically presented, or they may comprise hand-held devices which are to be manually presented to the said items.

According to another feature of the present invention, each indicia reading head incorporates, or has associated with it, a source of ultra-violet light for illuminating the indicia presented to it, and is responsive to indicia which fluoresce in that light. Preferably, for use with such a reading head, the indicia are formed on each item of equipment by impressing them into the metal or other material of the item, then filling the impression so made with a curable adhesive mixture of an ultra-violet fluorescing substance and an adhesive material such as an epoxy resin (e.g. an adhesive commercially available under the trade name ARALDITE), and then curing the mixture so as to render it firmly secured in the said impression.

According to another feature of the present invention, elongate items such as scaffold poles are inscribed with the same group of indicia at respective positions spaced apart at intervals (preferably uniform intervals), so that if such an item is sub-divided into two or more shorter items, each item so formed bears at least one set of indicia by means of which it can be positively identified.

According to yet another featur of the present invention, where an elongate item (e.g. a scaffold pole) bears the same group of indicia at spaced intervals, a further character is added to such group of indicia, which character changes in a sequential manner from group to group along the item, so that each successive length of the item is uniquely identified. This feature enables the determination to be made as to whether an item is complete, or otherwise is a shorter item produced by sub-dividing an original item.

Other features of the present invention will appear from a reading of the description that follows hereafter, and of the claims appended at the end of that description.

One scaffolding equipment monitoring system according to the present invention will now be described by way of example and with reference to the accompanying diagrammatic drawings.

In those drawings:

Figure 1 shows pictorially an indicia reading head, and adjacent it, a portion of a scaffold pole presented for reading indicia inscribed on that portion of that pole; Figure 2 shows schematically the arrangement of apparatus constituting the system; and

Figure 3 shows diagrammatically a die for impressing a scaffold pole at successive intervals along its length with its unique indicia and a sequentially changing character.

Referring now to the drawings, there is shown in Figure 1, by way of example, a tubular steel scaffold pole 10 having inscribed thereon near one end indicia 12 identifying uniquely the pole itself, and signifying at least the owner of the pole, and preferably its type and size, and any other desirable information apertaining to the pole. Those indicia, which may be in the form of alpha-numeric characters, a bar code, or any other form of coding, are impressed deeply into the metal of the pole, and are filled

with a cured mix of an epoxy resin (e.g. that available commercially under the trade name ARALDITE) and a substance which fluoresces when illuminated by ultra-violet light.

5 The end of the scaffold pole is shown presented in close proximity to an indicia reading head 14. That reading head incorporates a source 16 of ultra-violet light which is arranged to illuminate the row of indicia 12 on the pole, and alongside that source, a sensor 18 for receiving light
10 emanating from the fluorescing indicia material. That reading head also incorporates a decoding means 20 for decoding the signals produced by the sensor and providing in response thereto at an output circuit 22 digital output signals representing the indicia sensed by the sensor 18.

15 The reading head may be arranged so that sensing can occur either whilst the scaffold pole is held stationary adjacent the sensor, or whilst one of them is moving relative to the other. Moreover, the reading head may comprise a static
20 device to which the pole is physically presented, or it may comprise a hand-held mobile device which is manually presented to the stationary pole.

25 The indicia may be inscribed along the length of the pole, or transversely to the length of the pole, and the reading head is arranged accordingly, or to read indicia arranged in either manner.

30 Referring now to the system shown schematically in the Figure 2, that system comprises various units of apparatus disposed at a central station 24, and at a plurality of remote distribution stations 26 and manufacturing stations 28, and also at a remote interrogation (enquiry) station 30. Such apparatus is appropriately inter-connected, on demand,
35 continuously, or at predetermined intervals, by telephone and/or radio links 32.

The apparatus at the central station comprises a data

processing apparatus 34 and a local interrogation unit 36.
The data processing station includes a data processing unit
38 which operates under the control of a program unit 40 to
store in a central storage unit 42 data concerning each and
5 every item of scaffold equipment known to the system, and to
update that stored data, continually on demand, or at
predetermined intervals, in dependence upon input signals
received through input channels 44,46 from apparatus
disposed at the various remote stations 26,28.

10 The central storage unit 42 thus holds an up-dated register
of all items of scaffold equipment entered in the system,
and includes for each such item a unique identifier, the
owner, the type and size, the current location of the item,
15 the origin or destination in respect of any transfer already
initiated but not yet completed, and any other permanent or
variable information thought desirable to have readily
available for reference.

20 The apparatus at each of the distribution and manufacturing
stations 26,28 comprises an indicia reading head 14 and an
associated user terminal 48 which incorporates a manual
keyboard 50 for entering in respect of any item of
25 scaffolding equipment the identity of a distribution station
or a building site from which the item has been received so
as to provide for the central processor 34 an 'origin'
signal, or the identity of a distribution station or
building site to which the item is now to be transferred, so
as to provide for the central processor 34 an assigned
30 'destination' signal.

The remote interrogation station 30 incorporates a user
terminal 48 similar to that at the other stations 26, 28,
and this provides a means whereby requests may be presented
35 to the central processor 34 so as to cause it to output
signals representing the stored status of any item specified
in such an interrogation request. The user terminal also
incorporates a display unit or a printer 52, for displaying

or printing out the result of an interrogation request.

The system operates in the following manner:

5 When a manufacturer produces a new item for a specific owner
to a given order, that item is marked in the above recited
manner with indicia appropriate to that item, so as to
uniquely identify it and designate its owner, and its type
and size. The identity may include characters identifying
10 the manufacturer and a unique serial number allocated by the
manufacturer.

On leaving the manufacturing station, that new item is
presented to the local indicia reader, and at that time the
15 destination to which the item has been assigned and is about
to be despatched is keyed-in on the local user terminal.
The output signals produced by the reader and user terminal
are transmitted over the requisite link 32 to the associated
input channel 44,46 of the data processor 34, whereupon the
20 program unit uses those input signals, either immediately or
at some later instant, to enter the new data received into
the stored register held in the storage unit, and in
association with that entry the manufacturing station from
which the item originates, and the assigned destination.

25 On arrival of that item at its assigned destination, it is
presented to the local indicia reader, and the user terminal
is operated so as to signify the identity of either a local
storage bin at that station, or of a specific building site
30 to which it has been assigned and will be despatched.

On despatch of that item from that station, the item is
again presented to the local indicia reader, and the user
terminal is again operated to identify the destination to
35 which the item is now being despatched.

On both such occasions, the processor operates under the
control of the program unit on the information supplied to

it by the remote distribution station 26 to update the entry concerning that item.

5 In like manner, any future transfer of an item will cause the transmission of transfer data to the central processor, so that at all times after the processor has received information from a remote station 26 or 28, the stored register will show the updated information concerning that item, and likewise of all of the respective items entered in
10 the register. Hence, any interrogation request will result in the outputting of the latest status of the relevant item.

To ascertain the whereabouts of any specific item, the unique identity of that item is keyed-in at the central
15 interrogation unit, or at the remote interrogation station, and the program unit causes the processor to read out the entry currently stored in respect of that item and to transmit it for display or printing out at the interrogation terminal from which the interrogation request originated.
20

Whilst the user terminals at the respective distribution and manufacturing stations are not equipped to enable them to directly interrogate the stored register and receive responses therefrom, any particular user terminal may be so
25 equipped if desired.

The interrogation units may be used to ascertain or confirm the ownership and/or whereabouts of any specific item, and to detect whether any particular item has been
30 misappropriated.

Where hand-held indicia readers are used, each such reader may include a local power source and a local storage device for storing the indicia read from a plurality of items. In
35 such a case, the reader may have associated with it a base unit for receiving the hand-held device and for reading out therefrom the contents of such local storage device and transmitting the unloaded data to the appropriate input

channel of the central processor.

In determining whether a party in possession of a load of scaffolding items is rightfully entitled to the items in his possession, it is necessary to determine beyond all doubt who is the current rightful owner of the respective items. This can be readily done by causing the indicia present on the various items to be scanned by a reader, transmitting the reader output signals to the central processor, and causing it to interrogate the stored register held in the storage unit in respect of those items so as to ascertain the identities of the owners currently registered in respect of them.

This contrasts with the present system of showing ownership of scaffolding items, in which only the identity of the original owner is to be found on the respective items. There is no mechanism for keeping track of the movements and transfers of individual items, so that there is no immediate and certain way of ascertaining whether the possessor of scaffolding items has legitimately come into possession of items which bear the marking of another party.

Figure 3 shows a die assembly 60 for marking indicia on a scaffold pole 62. That assembly includes mounted on a common shaft 64 a plurality of circular discs 66, each of which carries around its peripheral edge a sequence of character forms 68. Whilst such an assembly is shown with six such discs 66, in reality such an assembly would include an appropriately greater or smaller number of such discs. The respective discs are rotatable relative to one another on the shaft, and are capable of being locked (by means not shown) in any one of a plurality of conditions, such as to exhibit in line with said shaft a desired combination 70 of for example alpha-numeric characters representing the identity number for a particular new scaffold pole. That assembly is rotated so as to have a peripheral linear speed equal to that of the pole 62 as it is moved past the die

assembly, and the pole is brought into physical contact with that line of characters 70 so as to mark the pole at predetermined uniformly spaced positions 76 thereon.

5 In order to separately and uniquely identify each successive portion of the pole, that assembly includes a further disc 72 mounted on the shaft, and an indexing means (not shown) for indexing that disc in between successive marking contacts of the disc assembly with the pole. That further
10 disc 72 carries around its periphery a sequence of numbers or letters 74. Hence, a pole marked with such a die assembly will bear the same unique identity marking at successive uniform intervals along its length, but each successive marking will include an extra character which
15 uniquely identifies the particular portion of the pole.

The system and apparatus just described above may be used to keep track of any other form of equipment or goods that have to be transferred periodically from one site or location to
20 another, or from one owner to another, during its lifetime.

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30

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CLAIMS

1. An equipment monitoring system for monitoring the
5 movements, and recording the whereabouts, of various items
of equipment, each of which is marked permanently at least
once with a unique, electronically-readable identifier,
which system includes:
- (a) at a central station, a programmed digital data
10 processor having a store in which a register of the
respective identifiers and current participating locations
of respective participating items is electronically
maintained, the processor being programmed to update
respective stored entries of the register in accordance
15 with received input signals, and to emit output signals
corresponding to the stored entry held in respect of any
particular item in response to received interrogation
signals specifying that item;
- (b) at each of a plurality of participating locations, an
20 identifier reading means for reading the identifier of each
item presented to it and for producing electric signals
corresponding to that identifier, and an input means for
transmitting to the data processor as said input signals
(i) electric location signals identifying the particular
25 location and (ii) the electric signals produced by the
reading head;
- (c) at each of one or more selected participating
locations, a marking means for inscribing permanently on
each item presented to it an identifier which has been
30 assigned uniquely to the particular item; and
- (d) at the central station and each of one or more
selected participating locations, an interrogating unit
comprising (i) sending means for transmitting to the data
processor interrogation signals specifying the identifier
35 of a particular item of which the present location is to be
ascertained, and (ii) receiving means for receiving from
the data processor said output signals in response to
interrogation signals transmitted to the data processor by
the associated sending means, and for displaying and/or

printing out the stored entry corresponding to the specified item.

5 2. A system according to claim 1, wherein each said stored entry includes other data specifying the owner of the relevant item.

10 3. A system according to claim 1 or 2, wherein each said stored entry includes other data specifying technical information apertaining to the relevant item.

15 4. A system according to any preceding claim, wherein each said stored entry includes the identity of a participating or other location to which the item is to be transferred.

20 5. A system according to any preceding claim, wherein each said input means includes a keyboard for enabling the input and transmission to the data processor of other data relevant to any particular item of equipment.

25 6. A system according to any preceding claim, wherein each said marking means is arranged to inscribe identifiers which fluoresce when irradiated with an ultra-violet radiation, and wherein each said reading head includes a source of ultra-violet radiation for irradiating the inscribed part of an item presented to the reading head, and the reading head is sensitive to and produces said electric signals in response to a fluorescing identifier.

30

7. An equipment monitoring system substantially as hereinbefore described with reference to and as illustrated by the accompanying diagrammatic drawings.

35 8. An item of equipment marked with an identifier which renders the item useful in a system according to any one of the claims 1 to 7.

9. An item of equipment according to claim 8, marked with

similar identifiers at a plurality of discrete positions, spaced apart on the item.

5 10. An item of equipment according to claim 9, wherein the respective identifiers marked at respective spaced positions on the item each include an auxiliary identifier which uniquely identifies an associated part of the item.

10 11. An item of equipment according to claim 9 or 10, which item comprises a scaffold pole.

15 12. A marking head for use in a system according to any one of the claims 1 to 7, which marking head is substantially as hereinbefore described with reference to and as illustrated by Figure 3 of the accompanying diagrammatic drawings.

20 13. A reading head for use in a system according to any one of the claims 1 to 7, which reading head is substantially as hereinbefore described with reference to and as illustrated by Figure 1 of the accompanying diagrammatic drawings.

25 14. An equipment monitoring system comprising any operative combination of the respective features disclosed in this specification, other than a combination that is covered by any one of the preceding claims.

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